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From : Stephen H. Kaiser, PhD

## *Comment #2 Legal Implications of the February 3 SWMI Water Management Framework Proposal*

In my first comment of March 8, I described an empirical method based on gage flow data to calculate the safe yield of rivers. I applied the method to one sub-basin on the Parker River. The results of this assessment indicate a major discrepancy with the results and recommendations of the SWMI study. Several other approaches considered by the state analysts, including the 25% of August Median, showed results that are much closer to my empirical model, with a difference of about ten percent. Such agreement is quite acceptable. By contrast, the SWMI recommendations show safe yield that are more than four times higher than the gage flow model or 25% of August Median. I am aware of no calibration or validation that supports the SWMI recommendations.

Others have raised concerns about the concept of "rolling up" or annualizing the monthly yields into an annual average. I believe the reasons for the high safe yield estimates of SWMI are a combination of annualization methods and the use of Q90 to represent drought flows.

### **PURPOSE AND INTERPRETATION IN THE LAW**

The DEP website asserts that the SWMI process "*attempted to find the right balance, one that protects our rivers and streams, but keeps water available to the communities.*" [February 6, 2012] This statement implies that in the past the right balance has not been found, notably the proposals of October 2009 -- but now the new proposals achieve this necessary balance. From my review, the proper balance has not yet been struck. Higher safe yields have been proposed that increase the potential for larger water withdrawals. These proposals seem to favor the interests of water suppliers, and not to protect rivers from zero-flow conditions.

On the CZM website, WMA goals are described : *"to protect water resources by limiting withdrawals to a 'safe yield.' .... water withdrawals that will not unduly stress the host river basin are permitted ...."* [updated February 4, 2012] Thus the technical question is this : does a set level of safe yield really protect water resources? Does protection of water resources cease when rivers are reduced to a zero-flow state? If that is the case, any safe yield resulting in a zero-flow condition would clearly be contrary to law.

Chapter 21G includes specific limitations on withdrawal actions that *"exceed the safe yield of the water sources from which the withdrawals are being made."* The law specified that -- to obtain an existing use registration together with an excess volume -- the safe yield must be identified and assessed. DEP has not formally adopted safe yields at any time in the past 25 years and thus cannot legally issue an existing use registration to allow such excess flows.

Section 5 provides that nothing in section 5 will prevent an applicant *"for an existing withdrawal from obtaining a permit pursuant to section eleven."* However, Section 11 contains similar language to Section 5, to the effect *"If the department finds that the combined volume of existing and proposed withdrawals exceeds the safe yield of a water source ... it shall deny all applications to permits for withdrawals from that water source."* Subtle differences in language are important : when DEP makes no determinations of safe yield, the agency cannot make a finding that proposed withdrawals exceed the safe yield. Logically, a permit can thereupon be approved.

I see these two sections of the regulations as placing water suppliers in a very challenging position. When DEP issues no figures for safe yield, they are limited to existing withdrawals with no exceedences in seeking water registrations. When DEP does estimate safe yield and the safe yield figure is below existing and proposed withdrawals, the permit request must be denied.

DEP's regulations at 36.26(1)(a) require that in reviewing a permit application DEP *"shall consider ... the water available within the safe yield as determined by the Department"* in section 31. The clear implication and apparent intent is that wherever DEP had not determined a safe yield, it would be unable to comply with the requirements of 36.26(1)(a) to consider safe yield in considering a permit application.

There is one possible strategy for water suppliers to avoid this dilemma : DEP would choose not to determine safe yields. In that way DEP need not substantively *consider* a determination they had not made. It could also interpret the finding to be made on safe yield as optional. A permit could subsequently be issued without a safe yield finding.

This logic sounds very contorted and other-worldly, but I have seen instances of lawyers devising similar “logical” conclusions and feeling quite proud of themselves. In the absence of such safe yield definitions, a permit for added withdrawals from a stressed river could become obtainable.

Today, it appears clear from recent court decisions, notably the Ipswich case, that such a strategy is no longer viable. DEP must calculate safe yield and include environmental factors in their determination.

EEA has recognized these court instructions. Its February 3 proposals define safe yield from 28 river basins and include an *Environmental Protection Factor* or EPF. These results consider several different formulas for safe yield, including annualized Q90 and 25% of August Median. We need to consider the definition of safe yield in Chapter 21G and other factors to discover which of the different safe yield formulas do or do not comply with the law.

#### CHAPTER 21G DEFINITION OF SAFE YIELD

Safe yield is defined in Chapter 21G, Section 2 and in DEP regulations 310 CMR 36.03 as “*the maximum dependable withdrawals that can be made continuously from a water source including ground or surface water during a period of years ...*” This period is linked to a time of greatest water deficiency. Dependability is recognized as being a function of drought probability.

The key terms in this definition are *dependable*, *continuously*, *a water source*, *a period of years*, *period of greatest water deficiency* and *drought probability*. The *period of greatest water deficiency* would appear to represent water availability in a record drought. The reference to *a period of years* suggests a minimum of two years. For its Russell Biomass permit, DEP considered the record of Westfield River low flows over a 40-year period. SWMI considered flow data over a 44-year period from 1961 through 2004.

I interpret the meaning of *continuous* to exclude a loss of continuity for any period of time -- for one day, one hour or one minute. For the purpose of river flows which are commonly reported in average flow per day, the proper criterion would be the loss of continuous flow for one day during a period of two years or more.

The statutory definition is a pumping test. When a safe yield value results in a pumping condition that cannot deliver the desired flow, the safe yield value has been set too high.

The definition of *water source* is "*any natural or artificial aquifer or body of surface water, including its watershed where ground and surface waters are interconnected in a single hydrological system.*" The key elements are the interconnection of ground and surface waters and the absence of any geographical limitations. The water source could be an entire watershed or a sub-basin.

For example, where a well is close to a river, the ground and surface waters are interconnected into one water source. The all-encompassing definition would recognize aquifer and surface waters as separate water sources, as well as the combination of the two. The well near a river could cause a depletion in withdrawal when the river is sucked down to a condition of zero flow. Wells connected to a river cannot legally deplete it to zero flow because the river ceases to be a water source with a continuous withdrawal. The safe yield of the river has been exceeded because it ceases to give continuous flow when it has dried up.

For this reason, a crucial result of safe yield calculations should be an estimate of the number of times *over a period of years* that a river will be reduced to zero flow. If a river survives this test with no day having zero flow, its safe yield can be said to comply with the narrow statutory definition. To this extent, safe yield does provide an environmental benefit, by preventing the drying up of rivers. SWMI should have produced estimates of the frequency of zero-flow rivers.

The courts have found that the laws must be considered in their entirety. Chapter 21G provides for both water supply and environmental protection. EEA has respected this judgment and during the SWMI process has for the first time provided a definition of safe yield that is based on maintaining certain flow levels for the aquatic environment. This Environmental Protection Factor is basically designed to assure the fish will survive a drought.

With SWMI, total basin yield was divided into two parts -- a safe yield component and an EPF component. Safe yield was calculated as 55 % of the total, so the remainder or 45 % became the yield associated with the EPF. The implication is that this new "environmental" safe yield would provide a sizable river flow to maintain a healthy fish community. For every hundred gallons of basin yield assigned for water supply or other human uses, eighty-two gallons would be reserved for river flows.

The SWMI process has considered both basins and sub-basins, as they properly should do. But the reporting to date has been only for entire basins. The danger of defining safe yield keyed to entire basins is that the size and sensitivity of small tributaries high in the watershed cannot be judged on the safe yield of the entire basin at the estuary.

The solution is to “pro-rate” upper sub-basins so that safe yields are considered *at the point of withdrawal* and for the reduced size of the watershed that is involved. In addition, the various users making upstream withdrawals should be adjusted as well. In this way the integrity of the withdrawal process can be maintained throughout the watershed, with no violations of zero-flow limits or proper maintenance of EPF base flow in rivers during droughts.

But what happens in a watershed when a large downstream withdrawal causes a distant upstream tributary to reach zero flow? In terms of simple well pumping, the downstream level of flow would be adequate, but the interconnected upper tributaries could be considered part of the same overall water source. Furthermore, the goals of the EPF to protect for adequate environmental flows in the river would not be met. Thus I conclude that any withdrawal that causes a zero-flow condition anywhere in the watershed and regardless of the withdrawal location is in violation of Chapter 21G.

In conclusion, the statutory definition of safe yield is that the withdrawal is "safe" in the sense that it yields an assured and reliable amount of water for the public and is “environmental” in the sense it prevents zero flow conditions anywhere in the watershed during a drought.

### **OTHER LEGAL REQUIREMENTS and INTERPRETATIONS**

There are two provisions in the state Constitution having bearing on water policy issues. One is Article 97 of the Amendments, also known as the Environmental Bill of Rights, identifying a public right to *clean water* and to *the natural, scenic, historic and aesthetic qualities of their environment...* This provision acts to support the court interpretations for the need to provide environmental protection to rivers.

Article 7 of the Declaration of Rights of the state Constitution gives more general guidance to the purpose of the government to provides public service and not service for special interests, such as profit-making developers. The text reads that "*Government is instituted for the Common good ... and not for the profit, honor, or private interest of any one man, family, or class of men.*" In effect, there is a test of the Common Good that is required for all government actions, including water withdrawals.

In addition to Chapter 21G of the statutes, EEA must also seek compliance with Chapter 30, Sections 61 and 62 -- that state agencies must minimize the environmental impacts of their decisions, seek mitigation, and consider alternatives in their decisionmaking.

Some court cases and case law are worthy of note. In a February 2007 ruling on a tidelands case, the Supreme Judicial Court in *Moot v. DEP* concluded that the Department of Environmental Protection had failed to protect public trust rights. The specific action was adopting regulations that were not authorized by the Legislature. As a result, the Legislature was compelled to approve Chapter 168 of the Acts of 2007 to provide this necessary authorization. For the purposes of SWMI, an assessment must be made whether the recommendations and draft regulations in preparation are indeed consistent with Chapter 21G and other authorizations by the Legislature.

An example of severe deviation from the original statute occurred in the January 31, 1992 version of the WMA regulations 310 CMR 36.00. The term *safe yield* was defined quite differently :

*"Safe yield means the maximum annually averaged daily water use consumptive loss rate that can be sustained from a water source with an acceptable degree of risk."*

The statute makes no reference to annual averaging, to consumptive loss rates or to *an acceptable degree of risk*. There is no reference to drought or *a period of years*. Only by implication from the word *risk* are drought conditions recognized. Section 4 of Chapter 21G does refer to *nonconsumptive use* but only in the context of determining whether a withdrawal is in excess of the threshold volume of 100,000 GPD. It does not apply to any consideration of safe yield or exceedences of safe yield. To this extent, the regulatory references to safe yield as *annually averaged*, *consumptive loss rate* and *acceptable rate of risk* are all regulatory inventions that have no place in the statute, and would appear contrary to the court finding in *Moot*.

In the recent SWMI effort, frequent reference is made to *drought years* -- using a term that is never defined. The drought year concept appears a continuation of the 1992 regulatory definition that emphasizes *annually averaged* water use. This concept appears to include months during which there are no drought conditions, such as February through April -- normally very wet months. When used to construct safe yield, the drought year produces disproportionately high values for safe yield. These high values leave the impression that larger withdrawals would be allowed, although prudence in evaluating true drought conditions would conclude otherwise.

Moreover, the drought year concept has clearly been violated in the the year 2010 for key locations such as Parker and Westfield Rivers. That year was characterized by record rains in March, followed by a period of below-average rain from May through November. The entire year of 2010 created average flows in the Parker of 24 cfs, but the drought period was not a year but covered

about 8 months of drought before normal conditions returned. For the Parker all-time low-flow records were achieved, while with the Westfield, 50-year low-flow levels were matched.

Finally, there is no comparable treatment of flooding which recognizes a “flood year.” Over the years agencies such as FEMA have adopted flood designations based on probability of occurrence. The ten, fifty and hundred-year events are defined by the highest elevation (crest) or greatest daily flow that occurs or is likely to occur over a statistical ten, fifty or one-hundred years. There is no flood year. There is no annualized flood. It is a single event that may occur over a lengthy period of time. It is analogous and consistent with the definitions of water deficiencies in the WMA.

DEP regulations give no definitions for either flood or drought. Because the WMA makes explicit reference to “drought probability,” the agency should have provided a technical definition as part of its regulatory functions. This definition should be included in the next regulatory revisions, and should define the record drought as being measured at its lowest point (in flow or water level) and not by an annualized number. DEP will need to clarify this point in its regulations and permitting decisions.

Droughts are different from floods in one vital respect. Withdrawals make a difference in droughts, but are inconsequential during floods. Increased severity of droughts is caused by two factors : greater watershed impermeability and growth in summertime water use. Rising impermeability means that runoff is quicker and ground water is not fully recharged to provide river flows during the dry months. The spread of suburban lawns and swimming pools has caused summer use of water in some communities such as Georgetown to be double the water use of winter months. The trend line in many rivers has been towards lower summer flows in recent years. The low flows during the almost unnoticed “great drought of 2010” occurred only 18 months ago, and for the Parker River the drought flows were lower than in the 1963-65 period.

This evidence about lower and lower summer flows is important to the regulatory definition of “safe yield” because in order to protect both water supplies and river flows for fish and other riverine life, the safe yield may decrease in the future as impermeability increases. It will not be a fixed value in time.

Evidence for the Parker River is that the Georgetown municipal wells contribute significantly to the summer drawdown of the river. The reason appears to be the close proximity of the wells to the river. If a well were dug further from the river and down to bedrock (similar to the Byfield well) river drawdown could be less, and the allowable safe yield could increase.

## COMPATIBILITY OF THE ENVIRONMENTAL PROTECTION FACTOR

Section 7 of Chapter 21G contains ten factors that must be considered by DEP in reviewing a permit. One of these ten is safe yield, so this listing could be considered as "safe yield and the nine other factors." No practical solution has occurred until the SWMI process introduced two new concepts : the Environmental Protection Factor and streamflow criteria.

Can the EPF and streamflow criteria provide the necessary protections of "the nine other factors"? At first glance, the EPF by itself would seem sufficient. For the Parker watershed, the total yield is divided into two parts -- a safe yield which represents the water available for practical human uses -- 55 % of the total. The balance or 45 % is intended as water to replenish the river and provide streamflow during even the most difficult drought conditions. For the Parker, SWMI figures indicate that for an existing average daily use of 2.33 MGD, the safe yield is projected to be 14.8 MGD. By implication the EPF element would be 12.1 MGD or 82 % of the safe yield.

As noted above, the EPF sounds very generous and would normally appear to meet many of the environmental objectives of Section 7 of Chapter 21G. However, the EPF of 12.1 MGD of yield at Parker disappears entirely during drought periods when a river approaches zero-flow conditions. The clear evidence is that the EPF is not adequate to the task, if annualized Q90 flows are accepted as defining both safe yield and the EPF.

The new concept of streamflow criteria would remain as the sole remaining bulwark of environmental protection for the rivers. However, criteria are not "standards" and the Legislature delegated the responsibility to DEP in Chapter 21G to specify "*criteria and standards*" for the implementation of the WMA regulations. Where are the standards that DEP would consider? If safe yield and EPF are not standards, what are? The courts have assumed in their decisions that there is strength in the application of the Water Management Act. The weakness would appear to be in agency regulations, the operable interpretations, and enforcement under the act.

## CONDITIONS ON PERMITS

DEP can and does place conditions when it issues permits. During periods of drought or very low flow, allocated withdrawals could be reduced either by conservation or throttling down the rate of withdrawal, until such time as all withdrawals must cease. This is a remarkable condition in the WMA permit for Russell Biomass, and agreed to by the applicant.

Such a condition would recognize the seasonality of river flows, and that during many months of the winter and spring large withdrawals could easily be accommodated for many rivers, yet during summer months -- and especially during a drought -- the permitted withdrawals should be reduced to match the available capability of the water source.

In the example of the Georgetown wells in the Parker River watershed, the water use during summer months is twice the use during winter months, according to the Horsley-Witten report of June 2008. A key recommendation of this report was that the town reduce this discrepancy down to a ratio of 1.2 to one through proper water budgeting. That shift would require voluntary compliance by the town, but could be encouraged or mandated by DEP through conditions in the WMA permit.

Conditions in WMA permits can serve to achieve an improved water balance for use and conservation, with the health of rivers being protected consistent with Chapter 21G.

### **EFFECTIVE ADVISORY COMMITTEES and OUTREACH**

The original WMA legislation included the formation of a water resources management advisory committee para 3 & 4 of Section 3) with a membership of at least 11 persons. With this flexible definition, it should be possible to merge the three committees and continue with SWMI functions under the statutory Water Resources Management Advisory Committee.

### **MULTIPLE TIERS OF PROTECTION**

In order to give full assurance to the provisions of Chapter 21G, a strategy of several tiers of protection could be created, consisting of the following :

- \* Calculation of drought-based safe yield
- \* Provision for an Environmental Protection Factor
- \* Conditions on permits issued, esp. for periods of very low flow in rivers
- \* Advisory Committee process

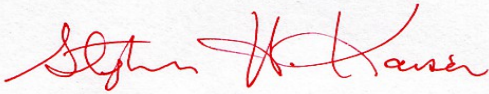
## CONCLUSIONS

The definition of safe yield prevent the issuance of new permits that would reduce any part of a river or tributary to zero flow. Safe yield narrowly defined is partly environmental, but does not assure that there will be enough water left in a river to maintain an adequate riverine habitat. An effective Environmental Protection Factor serves to provide additional river flow during drought periods to protect the aquatic environment and meeting the added environmental requirements of Chapter 21G and Streamflow criteria. Conditions on new or renewed permits can also be used to assure that Compliance with the environmental protections of Chapter 21G are complied with.

There will be instances where safe yields must be reduced because of increasing levels of impervious surfaces in the watershed or the construction/operation of wells close to river channels. Similarly, safe yield can be increased by moving wells further away from river channels, or summertime reductions in the use of wells close to rivers.

Safe Yield models which appear to perform most closely in compliance with the WMA are 25% of August median ..... 10%-10%-25%-15% Q90 ..... and the empirical gage flow model. The Annualized Q90 methodology recommended by EEA results in very high safe yield estimates, and the practical disappearance of any Environmental Protection Factor. There will be increased incidence of zero-flow rivers during droughts. I conclude that any model based on Annualized Q90 methodology is contrary to the requirements of the Water Management Act. Finally, the term *drought year* has neither technical nor legal standing in determining safe yield, and should be replaced by drought period which could cover a period of weeks or several months.

Sincerely,



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